NOTES ON THE SAND FLIES (DIPTERA: PSYCHODIDAE) OF SOUTHERN ARIZONA[1]

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ABSTRACT: Two hundred twenty-eight sand flies were collected during a total of 30 trap nights conducted at two locations in southern Arizona. *Lutzomyia apache* was the species most commonly collected; *Lu. anthophora*, *Lu. californica* and an undescribed species of *Lutzomyia* also were present. Data on the abundance, trophic status, sex ratio, fecundity and geographic distribution of these insects are presented.

The leishmaniases are a complex of sand fly-borne, parasitic diseases which infect a wide range of vertebrate hosts. In the United States, locally-acquired, human cases have been reported from southern and central Texas (McHugh et al. 1996). The etiologic agent in this area, *Leishmania mexicana* Biagi, is transmitted among woodrats (*Neotoma micropus* Baird) by the sand fly *Lutzomyia anthophora* (Addis) (McHugh et al. 1990, McHugh et al. 1993, Kerr et al. 1995). Until recently, rodent isolates of *L. mexicana* have been limited to *N. micropus* collected in south Texas. However, given the wide host range of *Leishmania* spp., McHugh et al. (1996) suggested that leishmaniasis could potentially occur anywhere in the United States where sand fly vectors are found. To test this hypothesis, collection and screening of rodents for *Leishmania* and collection of associated sand flies was conducted in southern Arizona where *Lu. anthophora* is known to occur (Mead and Cupp 1995). This note reports the results of those sand fly collections.

MATERIALS AND METHODS

Collections were made at two locations in the Buenos Aires National Wildlife Refuge (BANWR), Pima County, Arizona. The refuge comprises approximately 46,540 ha paralleling state highway 286 southwest of Tucson. It is in the Sonoran life zone, and vegetation is a mix of desert shrub and mesquite grassland with riparian corridors.

Trapping was conducted along Arivaca Creek (approx. loc. 31°35'30" N, 111° 21'45" W), about 5.5 km northwest of the town of Arivaca. This intermittent creek was lined with grasses, shrubs and trees, primarily cottonwoods (*Populus* sp.), and mesquite (*Prosopis* sp.). Nests of white-throated woodrats (*Neotoma albigula* Hartley) were common among the brush and downed trees along the banks of the creek. Mead and Cupp (1995) reported collections of *Lu. anthophora* associated with woodrats and rock squirrels

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(Spermaphilus variagatus) [Erxleben]) in this area. *Leishmania mexicana* was detected in six of 18 (33%) white-throated woodrats collected along the creek. (Kerr et al. 1999).

Additional collections were made at a refuse area located near the El Cazador bunkhouse area (approx. loc. 31°50'10" N, 111°23'50" W) at the northern end of the refuge. Numerous white-throated woodrat nests were scattered among the discarded equipment, cans, barrels, lumber, and cars at the refuse area. The surrounding area was primarily mesquite savanna. None of 10 woodrats collected at this site was *Leishmania*-positive.

Solid-state Army miniature light traps were suspended above active nests and debris piles created by woodrats. A total of 30 trap nights, 19 along Arivaca creek and 11 at the El Cazador refuse area, were conducted from 28 September through 2 October 1998. The choice of dates was based on evidence that in Texas transmission of *Leishmania* takes place primarily in the fall (Kerr et al. 1995) and that adult sand flies were present at BANWR at this time (Mead and Cupp 1995).

Flies were anesthetized with triethylamine, cleared in 89% liquid phenol, and identified using the keys of Young and Perkins (1984). The trophic status – unfed, bloodfed, gravid – of females was noted and, when possible, the number of ova in gravid females was determined.

RESULTS

A total of 228 sand flies was collected (Table 1). Specific determinations were made for all but three individuals, one male and two females. Accounts for the three described and an undescribed species collected on the refuge are provided following the table.

Table 1. Sand flies collected at two sites in the Buenos Aires National Wildlife Refuge, Pima County, Arizona, 28 September through 2 October 1998.

	Arivaca Creek[1]		El Cazador Camp[2]	
Species	Female	Male	Female	Male
Lutzomyia apache	135	56	1	8
Lutzomyia anthophora	4	—	1	1
Lutzomyia californica	1	—	4	2
Lutzomyia sp.	2	—	6	4
Total	142	56	12	15

[1] 19 trap nights. 1 male, 1 female *Lutzomyia* sp. undetermined.
[2] 11 trap nights. 1 female *Lutzomyia* sp. undetermined.

Lutzomyia apache Young and Perkins

This species was the most abundant, comprising 88% of the total specimens collected. A majority of these came from just a few nests along Arivaca Creek. There, four one-night collections yielded 54, 19, 19 and 16 individuals. The female:male sex ratio at the creek was 2.4:1. Of the 135 females collected at Arivaca Creek, five were bloodfed and eight were gravid, indicating that *Lu. apache* is reproductively active during the fall in southern Arizona. The mean number of mature ova for six gravid females which were dissected was 54.2 (range 25-87, s.d. 21.1). Both male and female *Lu. apache* also were collected at the El Cazador dump, although not in such disproportionate numbers. Whether the abundance at Arivaca Creek was due to habitat preference or phenology of adult flies is unknown.

Three females collected at Arivaca Creek initially appeared to be gravid, with abdomens that were opaque and distended. On dissection, their abdomens were found to be filled with nematodes. A specific determination was not made, but most appeared to be third-stage filarid larvae (Bain and Chabaud 1986). One of the females also contained two additional forms, one of which was shorter and fatter, reminiscent of the early, "sausage-stage" seen in many filarids. *Dunnifilaria meningica* Gutierrez-Pena (Filarioidea: Onchocercidae) has been reported from *N. micropus* (Gutierrez-Pena 1987), a species closely related to *N. albigula*, and microfilariae similar to those of *D. meningica* were seen in several *N. albigula* collected at Arivaca Creek (S.F. Kerr, unpublished data). The host preference of *Lu. apache* is unknown. Other species of sand flies in the subgenus *Helcocyrtomyia* are reptile and/or amphibian feeders (Young and Perkins 1984), suggesting *Lu. apache* feeds on cold-blooded vertebrates. However, the presence of filarids in the flies and woodrats at Arivaca Creek and the association of *Lu. apache* with woodrat nests may indicate a preference for rodent hosts.

Lutzomyia apache was described from specimens collected in Apache and Cochise counties, Arizona, and is also known to occur in Gila County, Arizona (Young and Perkins 1984). The collection of *Lu. apache* at the BANWR is the first published report of this species from Pima County. Alsuhaibani (1990) collected specimens of *Lu. apache* in Larimer County, Colorado, in association with prairie dog (*Cynomys ludovicianus* [Ord]) burrows. This species is not known from Mexico, but, given its known range from northern Colorado southward to the U.S.-Mexican border and its abundance at Arivaca Creek, this species likely occurs at least into northern Mexico.

Lutzomyia anthophora (Addis)

This species was represented by two unfed and two gravid females collected at Arivaca Creek and a single male and unfed female at the El Caza-

dor dump. Almost all United States records for this species were from southern and western Texas (McHugh 1991, Young and Duncan 1994). Mead and Cupp (1995) reported collections of this species at Arivaca Creek, thereby extending the known range of this species westward by about 724 km. It occurs southward to Morales State, Mexico. It is a nest associate of *N. micropus* (Endris et al. 1984, McHugh 1991) and is the vector of *L. mexicana* among these rodents (McHugh et al. 1996). The only isolates of *L. mexicana* from sand flies in North America, north of the Yucatan peninsula, are from *Lu. anthophora* collected in Bexar County, Texas (McHugh et al. 1993). *Lutzomyia anthophora* also is believed to be a vector of Rio Grande virus among *N. micropus* (Endris et al. 1983).

Lutzomyia californica (Fairchild and Hertig)

One gravid *Lu. californica* was collected at Arivaca Creek. Two males, three unfed females and a gravid *Lu. californica* were collected at the El Cazador refuse site. This species is wide-spread in the western United States, occurring in Washington, California, Arizona, and Texas (Young and Duncan 1994). The collections in the BANWF are the first published reports from Pima County, Arizona. This species may be conspecific with *Lutzomyia chiapanensis* (Dampf) which extends from Mexico southward into Panama (Young and Duncan 1994). *Lutzomyia californica* is believed to feed on reptiles (Chaniotis 1967).

Lutzomyia sp.

Four males and six unfed females of an apparently undescribed *Lutzomyia* species were collected at the El Cazador refuse area. Two unfed females were collected at Arivaca Creek. The armature of the male gonocoxite and gonostyle and the spermathecae and armature of the female cibarium are similar to that of *Lutzomyia shannoni* (Dyar), but the antennal ascoids lack the proximal spurs found in *Lu. shannoni*. The spermathecae of the undescribed species are extremely hyaline and often difficult to visualize. It is likely that the two female *Lutzomyia* collected in the BANWR for which determinations were not made belonged to this undescribed species. Examples of this species previously were collected at the residences of two cases of human leishmaniasis in Texas (P.G. Lawyer, unpublished data). Little is known of the biology of this undescribed species.

DISCUSSION

Three described and one undescribed species of sand flies were present at a focus of leishmaniasis in southern Arizona. Based on the presumed preference of *Lu. apache* for cold-blooded vertebrates and the known preference

of *Lu. californica* for reptiles, these species probably are not involved in transmission of *L. mexicana* among rodents. *Lutzomyia anthophora*, a species known to feed on woodrats and one which was consistently found at foci of leishmaniasis in Texas (C.P. McHugh, unpublished data), is a likely candidate for vector at the southern Arizona focus.

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